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A STRATEGY FOR WILDLIFE HABITAT MITIGATION FOR THE OLDMAN RIVER DAM RESERVOIR

by

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EXECUTIVE SUMMARY

In August 1984, the Government of Alberta announced that the Oldman River Dam would be constructed on the Oldman River. To ensure that environmental concerns resulting from the construction and operation of the reservoir were approached in a systematic and objective manner, Alberta Environment[1] set out a framework for a series of studies leading to the formulation of an Environmental Mitigation/ Opportunities Plan.

The Wildlife Component of the Environmental Mitigation/Opportunities Plan began in 1985 and 1986 with a review of available information, followed by field surveys. Because of the importance of the flooded area to wildlife, the Government of Alberta is working cooperatively with a local Fish and Widlife Sub-committee to design and implement a Wildlife Habitat Mitigation Program that will create and improve wildlife habitat around the reservoir.

The major objectives of the Wildlife Habitat Mitigation Plan are:

1. *To minimize the potential negative impacts of the Oldman River dam project on wildlife species, and*

2. *To take advantage of mitigation opportunities arising from the development of the dam and reservoir.*

The Delta Environmental Management Group Ltd. (The Delta Group) was retained to identify opportunities for wildlife habitat mitigation in the vicinity of the reservoir area and, on the basis of this inventory, develop practical and effective projects to protect, enhance or create wildlife habitat for implementation during 1988 to 1993.

Assumptions and Constraints to the Mitigation Plan

A number of assumptions are central to the development and implementation of the Wildlife Habitat Mitigation Plan:

1. *Wildlife habitat mitigation is defined as compensation for losses of wildlife habitat, that are incurred during the construction of the Oldman River dam and subsequent flooding of the reservoir, through the provision of alternate cover and/or cover/food habitat.*

2. *A suitable land base will be maintained under crown control for wildlife habitat mitigation purposes.*

3. *The Government of Alberta is committed to the long-term maintenance and management of the Wildlife Habitat Mitigation Program and land base.*

4. *If construction activities and reservoir operations provide opportunities for wildlife habitat mitigation, practical and cost-effective habitat projects will be considered for design and implementation as these opportunities arise.*

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[1] *As of November 1988, responsibility for construction of the Oldman River Dam Project was transferred from the Development and Operations Division of Alberta Environment to Alberta Public Works, Supplies and Services. Depending on the date of the reference, Alberta Environment and Alberta Public Works, Supplies and Services are therefore referred to as the project proponent.*

5. *The habitat mitigation plan will benefit a wide diversity of wildlife.*

6. *Wildlife habitat projects will be well distributed around the reservoir.*

7. *Wildlife habitat projects will include movement corridors for wildlife between core habitat areas around the reservoir area.*

8. *Wildlife habitat projects will be compatible with existing land uses.*

9. *In the event that an essential wildlife project is not feasible due to land ownership, incompatible land uses, and/or conflicts with construction activities, alternate habitat opportunities will be considered.*

10. *Downstream wildlife habitat mitigation opportunities will be considered in conjunction with the reservoir operational plan.*

11. *An assessment program will be implemented to monitor and evaluate wildlife habitat mitigation projects.*

Estimating Losses of Wildlife Habitat

Through the use of habitat evaluation models that simultaneously consider habitat quality and availability, it is estimated that ***689 Habitat Units (HUs)*** *will be lost to flooding. (One HU is equivalent to one hectare of optimal habitat.) In terms of the specific uses of these habitats by tree and shrub associated wildlife:*

- ***38 HUs*** *provide mostly cover (for example, Douglas fir communities),*
- ***445 HUs*** *provide mostly food (communities such as grasslands, cultivated fields and low shrubland areas), and*
- ***206 HUs*** *provide both cover and food (communities such as aspen and cottonwood stands and tall shrubland areas).*

Because of the importance of winter cover for tree and shrub associated wildlife, the principal focus of the Wildlife Habitat Mitigation Plan is to enhance or create cover and cover/food habitat.

Mitigation Techniques

Three groups of mitigation techniques will be used to compensate for losses of wildlife habitat that are incurred during the construction of the Oldman River dam and the flooding of the reservoir:

- *habitat protection*
- *habitat enhancement, and*
- *creation of new habitat*

Habitat protection measures are intended primarily to conserve and protect bottomland, upland and coulee habitats for wildlife. Three habitat protection measures are proposed: perimeter fencing of the land base for the Wildlife Habitat Mitigation Program, implementation of range management plans for integrated use of pasturelands by wildlife and cattle, and development of reservoir clearing guidelines to minimize losses of tree and shrub habitats that will not be substantially affected by the flooding of the reservoir.

Habitat enhancement projects involve the improvement and/or expansion of existing sites and habitats to provide more suitable and/or larger areas of habitat for

terrestrial and wetland wildlife than which presently exists. Four types of habitat enhancement measures will be incorporated into the Wildlife Habitat Mitigation Plan: enhancement of existing tree and shrub communities, wetland enhancement, modification of nesting cliffs, and improvement of native and seeded range.

Six methods of creating new habitat for wildlife will be considered for the Wildlife Habitat Mitigation Plan: establishment of new upland tree and shrub communities (including the construction of check dams and irrigation systems), development of new bottomland shrub and tree communities, development of new wetland basins, creation of several islands within the reservoir, construction of rockpiles for marmots, and reclamation of borrow areas.

Preparing a Habitat Mitigation Program for Wildlife

To achieve the objectives of the Wildlife Habitat Mitigation Program, it will be necessary to provide core areas of cover and food for shrub and tree-associated wildlife, as well as movement corridors along the reservoir edge. However, the plan also includes the enhancement and creation of wetlands and check dams to benefit water-associated wildlife, and to provide better growing conditions for transplanted trees and shrubs. Special structures such as rockpiles for marmot burrows, modifications of cliff habitats for relocation of prairie falcon nests, and creation of nesting sites for Canada geese on the reservoir islands have also been incorporated in the plan.

During the initial planning phase of the wildlife habitat mitigation program, a large number (145) of opportunities for protection and enhancement of existing habitat and creation of new habitat were identified in the vicinity of the Oldman reservoir. Opportunities were based only on the existing biophysical site conditions, and the potential to improve existing habitat conditions or create new habitat using proven mitigation methodologies or new technological advances in wildlife habitat mitigation. In contrast, the selection and priorization of mitigation projects for inclusion in the wildlife habitat mitigation plan took into account factors associated with the biological requirements of wildlife, compatibility with adjacent land use, land ownership, project cost, and project effectiveness.

Using these criteria and ongoing input from the Fish and Wildlife Sub-committee, an Action Plan for Wildlife Habitat Mitigation has been prepared as a companion report to this mitigation strategy. The Action plan describes actual projects which will be implemented to provide suitable replacement habitat for wildlife, the implementation schedule for the Wildlife Habitat Mitigation Plan, and an evaluation and maintenance program for the habitat projects.

Integration with other Components of the Oldman River Dam Project

The construction and operation of the Oldman River dam and the implementation of environmental mitigation programs for fisheries, recreation, vegetation, historical resources, agriculture and transportation will afford a broad range of opportunities for interaction and integration with the Wildlife Habitat Mitigation Program. Where possible, all such opportunities will be pursued in order to maximize benefits to the Alberta public.

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1.0 INTRODUCTION

In August 1984, the Government of Alberta announced that the Oldman River Dam would be constructed on the Oldman River, a short distance downstream of the confluence of the Castle, Crowsnest and Oldman rivers. Once completed, the dam will create a reservoir covering an area of 2420 ha at the full supply level (fsl) of 1118.6 m.

To ensure that environmental concerns resulting from the construction and operation of the reservoir were approached in a systematic and objective manner, the Planning Division of Alberta Environment[1] set out a framework for a series of studies leading to the formulation of Environmental Mitigation/ Opportunities Plans for fisheries, wildlife, historical resources, and recreation (Alberta Environment 1988a). The mitigation plans, which were initiated in 1985, will be completed in four general phases:

- Overview and data collection,
- Assessment and mitigation design
- Mitigation implementation, and
- Monitoring

The Wildlife Component of the Environmental Mitigation/Opportunities Plan began in 1985 and 1986 with a review of available information on wildlife resources in the Oldman River region, followed by field surveys of ungulates and other wildlife (Westworth and Brusnyk 1984; Allison and Russell 1985, 1986; Young et al. 1986; Young 1988a,b). Much of the valley area to be flooded by the dam is locally important habitat for a variety of wildlife species. Approximately 350-400 mule deer overwintered in and around the reservoir area during 1985-86, with slightly more than half that number being present during the spring and summer months (Allison and Russell 1986). The valleys of these three rivers also provide seasonal or year-round habitat for a variety of other wildlife including white-tailed deer, moose (uncommon), at least two colonies of yellow-bellied marmots, mink, badgers, beaver, nesting Ferruginous hawks, prairie falcons and Canada geese, mallards, and common mergansers (Young et al. 1986).

Because of the importance of the flooded area to wildlife, Alberta Public Works, Supplies and Services (Oldman River Dam Project) and the Fish and Wildlife Division of Alberta Forestry, Lands and Wildlife, along with the local Fish and Wildlife Sub-Committee are working cooperatively to design and implement a Wildlife Habitat Mitigation Plan as one component of the Environmental Mitigation/ Opportunities Plan. As habitat will be lost to construction and flooding, the wildlife habitat mitigation plan is designed to create and to improve wildlife habitat around the proposed reservoir site.

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[1] As of November 1988, responsibility for construction of the Oldman River Dam Project was transferred from the Development and Operations Division of Alberta Environment to Alberta Public Works, Supplies and Services. Depending on the date of the reference, Alberta Environment and Alberta Public Works, Supplies and Services are therefore referred to as the project proponent.

The major objectives of the Wildlife Habitat Mitigation Plan, as described by Alberta Environment (1988a) are:

1. ***To minimize the potential negative impacts of the Oldman River dam project on wildlife species, and***

2. ***To take advantage of mitigation opportunities arising from the development of the dam and reservoir.***

In May 1987, Alberta Environment retained The Delta Environmental Management Group Ltd. (The Delta Group) to identify opportunities for wildlife habitat mitigation in the vicinity of the reservoir area and, on the basis of this inventory, develop practical and effective projects to protect, enhance or create wildlife habitat for implementation during 1988 to 1993. The wildlife baseline studies, as well as information from the Alberta Fish and Wildlife Division, Alberta Environment, the Local Advisory Committee, other local residents, and numerous field trips to the Oldman River area, aided in the selection and design of appropriate habitat projects.

This report presents the steps taken in developing a Wildlife Habitat Mitigation Plan for the Oldman River dam project. In the following chapters, the general objectives and scope of the study, the major assumptions and constraints to planning, the amount of habitat that will be lost to flooding, the subsequent habitat needs of local wildlife after flooding, and the types of habitat improvement projects required to best meet these needs are described. A mitigation strategy for wildlife in the vicinity of the Oldman River dam project, and the approximate costs to implement this strategy are also discussed. A monitoring program is recommended to assess the success of vegetation establishment, quantify changes in habitat suitability as a result of the mitigation program, and evaluate wildlife use of specific mitigation projects.

2.0 STUDY OBJECTIVES AND SCOPE

To fulfil the two major objectives of the Wildlife Habitat Mitigation Plan, the following tasks were outlined in the Terms of Reference for the wildlife habitat mitigation study:

- Estimate the current quality and availability of wildlife habitat in the vicinity of the dam and determine the amount of habitat that will be lost from flooding;
- Identify locally important habitat which might be set aside for wildlife;
- Identify options for management of bottomland areas that will aid in the maintenance and enhancement of wildlife habitat upstream and downstream of the dam, while also benefiting cattle range;
- Identify construction sites, such as borrow pits, which can be reclaimed as wildlife habitat, and prepare reclamation plans for these sites which are both compatible with construction activities and cost-effective;
- Determine if off-site mitigation opportunities for wildlife are possible such as the creation or improvement of wetlands for waterfowl using reservoir water reserves;
- Identify opportunities for combining agricultural uses of land with enhancement of wildlife habitat;
- In cooperation with Alberta Environment and the Alberta Fish and Wildlife Division, identify the preferred habitat projects on the basis of cost-benefits and prepare site plans for these projects; and
- Outline a program to monitor the effectiveness of the completed habitat projects in and around the reservoir.

3.0 ASSUMPTIONS AND CONSTRAINTS OF THE MITIGATION PLAN

To achieve the major objectives of the Wildlife Component and complete the tasks described in the Terms of Reference, a number of assumptions are central to the development and implementation of the Wildlife Habitat Mitigation Plan. Assumptions and constraints of the wildlife habitat mitigation plan were discussed and refined in a series of meetings in 1987 involving the local Fish and Wildlife Sub-committee, Alberta Environment, Alberta Fish and Wildlife Division and The Delta Group Ltd., and are as follows:

1. ***Wildlife habitat mitigation is defined as compensation for losses of wildlife habitat, that are incurred during the construction of the Oldman River dam and subsequent flooding of the reservoir, through the provision of alternate cover habitat and/or cover/food habitat.*** Because of the importance of tree and shrub cover and physical cover to wildlife, a major portion of the mitigation plan will focus on the protection and/or enhancement of existing tree/shrub and physical cover and the creation of new tree and shrub cover around the reservoir. Cover habitats and cover/food habitats include Douglas fir, limber pine, aspen, cottonwood, and saskatoon - chokecherry communities as defined by Hardy Associates Ltd. (1986).

2. ***A suitable land base will be maintained under crown control for wildlife habitat mitigation purposes.*** Wherever possible, wildlife habitat mitigation projects will be located on crown land with low agricultural capability.

3. ***The Government of Alberta is committed to the long-term maintenance and management of the Wildlife Habitat Mitigation Program and land base.*** Although wildlife habitat mitigation projects will be low-maintenance or maintenance-free, specific government agencies will be assigned responsibilities for the long-term maintenance and management of the various habitat measures and land base.

4. ***If construction activities and reservoir operations provide opportunities for wildlife habitat mitigation, practical and cost-effective habitat projects will be considered for design and implementation as these opportunities arise.*** The wildlife habitat mitigation planning process will be integrated with engineering and transportation planning and reservoir operations to maximize opportunities for incorporation of low-cost habitat development projects with construction and operation activities.

5. ***The wildlife habitat mitigation plan will benefit a wide diversity of wildlife.*** In order to benefit as wide a range of wildlife as possible, while still providing adequate alternate habitat for tree and shrub associated wildlife, mitigation projects will also be developed for wetland-associated wildlife, nesting raptors and Canada geese, and small mammals.

6. ***Wildlife habitat projects will be well distributed around the reservoir area.*** To ensure a good distribution of habitat projects throughout the Oldman, Crowsnest and Castle river regions of the reservoir, projects will be implemented in all regions around the reservoir.

7. ***Wildlife habitat projects will include movement corridors for wildlife between core habitat areas around the reservoir area.*** Because wildlife such as mule deer are reluctant to move long distances away from tree/shrub cover or physical cover, blocks of tree/shrub habitat will be provided at intervals no greater than 1.6 km (1.0 miles) from the nearest block of existing or newly-created tree/shrub habitat.

8. ***Wildlife habitat projects will be compatible with existing land uses.*** Habitat projects will be designed to complement existing blocks of wildlife habitat and agricultural uses. In particular, range management plans will be developed for some mitigation projects to permit use by cattle without seriously impairing habitat capability for wildlife. Establishment of large blocks of wildlife habitat will also be avoided in proximity to cereal or forage crops.

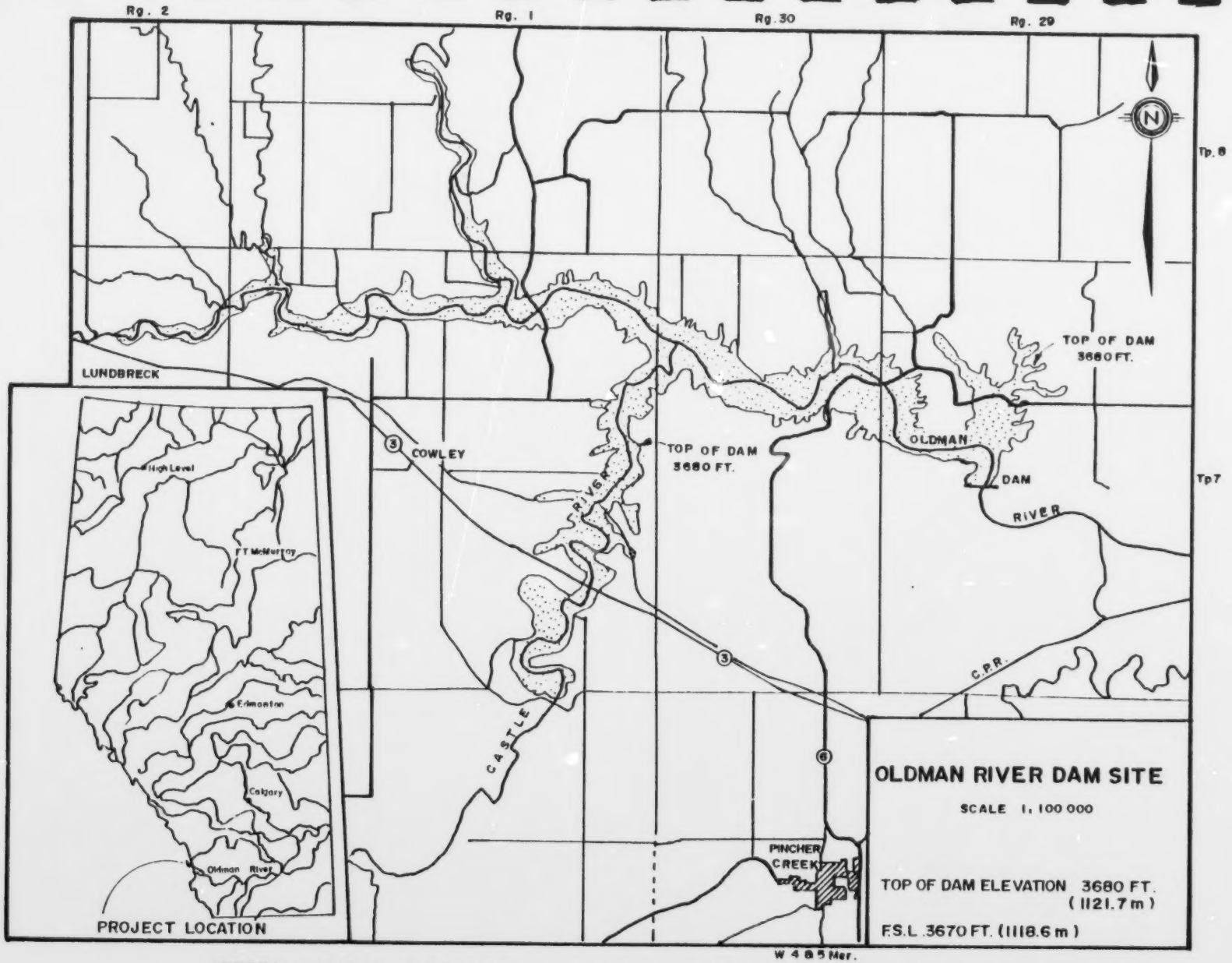
9. ***In the event that an essential wildlife project is not feasible due to land ownership, incompatible land uses, and/or conflicts with construction activities, alternate habitat opportunities will be considered.***

10. ***Downstream wildlife habitat mitigation opportunities will be considered in conjunction with the reservoir operational plan.***

11. ***An assessment program will be implemented to monitor and evaluate wildlife habitat mitigation projects.*** An assessment program will be designed and implemented to (1) monitor the establishment of vegetation in habitat projects and the use of habitat projects by wildlife, (2) inspect structures and other habitat components on a regular basis to ensure that they are functioning correctly, and (3) where problems exist, to recommend and implement corrective measures as necessary.

4.0 THE STUDY AREA

For the purposes of the Wildlife Habitat Mitigation Plan, no rigid study area boundaries were established and all habitat opportunities within a reasonable distance of the reservoir were considered (Plate 1). Wherever possible, lands immediately downstream and upstream of the dam, and along the perimeter of the reservoir were incorporated into the mitigation plan to ensure that the localized wildlife populations most affected by the dam would realize benefits from habitat enhancement and creation.



GENERAL LOCATION OF THE STUDY AREA FOR THE OLDMAN RIVER WILDLIFE HABITAT MITIGATION PLAN

PLATE 1

5.0 ESTIMATING LOSSES OF WILDLIFE HABITAT

More than 40 mammal and 150 bird species potentially inhabit the study area on a seasonal or year-round basis. Most of these species rely on forested and shrubland areas, as well as the physical relief of the river valley, for protection against predators, cold winter winds and/or deep snow. Since flooding will eliminate a large proportion of the forests, shrublands and sheltered slopes occurring within the river valleys immediately upstream of the dam, the primary focus of the mitigation plan was to create, enhance or protect tree and shrub cover around the reservoir. Such measures for wooded cover will also benefit wildlife such as mule deer, upland game birds, songbirds, jack rabbits, marmots, weasels, coyotes and red fox.

Although information on the type and amount of habitat to be lost to flooding is required to prepare a mitigation plan, it is not feasible to undertake an assessment of habitat loss for each different species considered of importance to the area. To simplify the planning process, a key species, whose cover needs were considered to represent most needs of a variety of forest and shrubland-dependent wildlife, was selected to determine habitat loss and appropriate improvement projects. Mule deer was selected as the key species for the following reasons:

- it is one of the more numerous and important species in the area, with more than 350 animals wintering in the vicinity of the proposed reservoir;
- it relies heavily on forests, shrublands and sheltered slopes for cover and much of its food;
- because of previous wildlife surveys conducted along the Oldman River, the habitat preferences of mule deer in the study area are better understood than the habitat preferences for other species. Therefore, existing information on mule deer distributions and habitat preferences could be used to better quantify habitat losses and future habitat needs for the study area.

Although mule deer were used as the key species for the development of much of the plan, it must be emphasized that **the mitigation plan is not solely for mule deer. Development of tree and shrub cover for mule deer will also benefit a variety of bird and small mammal species that are associated with tree and shrub communities in the Oldman River region.**

A number of specialized habitat projects such as the creation and enhancement of wetlands, construction of nesting platforms or islands for waterfowl, modification of cliff nesting sites for prairie falcons, Ferruginous hawks and Canada geese, development of nesting sites for Canada geese on islands in the reservoir, and improvement of several sites for marmots are also

included in the mitigation plan. These projects will provide benefits to other species and groups of wildlife, over and above the benefits for tree and shrub-associated wildlife.

5.1 ESTIMATING LOSSES OF TREE AND SHRUB HABITATS

The proposed dam will flood approximately 2420 ha of land. The reservoir area is a complex mosaic of nine major plant communities:

- Douglas fir,
- Limber pine,
- aspen,
- cottonwoods,
- skunkbush - creeping juniper,
- saskatoon - chokecherry,
- rough fescue - oat grass,
- western wheatgrass - June grass, and
- cultivated fields.

Each of these communities have a different food and cover value for wildlife. To measure the habitat values for mule deer and other tree/shrub associated wildlife in the reservoir and, hence, determine the nature and amount of mitigation needed to replace such losses, some means of combining the quality and quantity of habitat in the different areas of the reservoir was required.

The U.S. Fish and Wildlife Service (USFWS 1980) has developed a method of measuring the amount or availability of wildlife habitat within a given area, called *Habitat Evaluation Procedures* (HEP, for short). Using information on the habitat needs and preferences of wildlife species, HEP involves the development of simple arithmetic models for specific wildlife species which rate the current value of habitat for that species. These ratings are referred to as *Habitat Suitability Indices* (HSIs). They range in value from 0.0 (unsuitable habitat) to 1.0 (optimal habitat), and rate the ability of a particular area of land to provide a wildlife species with its habitat needs such as food, hiding cover and bedding sites.

Habitat Evaluation Procedures have been successfully used to assess current habitat availability and potential losses in a number of industrial and agricultural studies within the United States and Canada. Within Alberta, HEP has been used to assess habitat loss from proposed hydro-electric dams (the Slave River Hydro Project), irrigation storage dams (the Willow Creek reservoir) and wetland drainage programs (Eccles et al.1986a, Eccles et al. 1986b, Green et al. 1986).

For the Oldman River Project, two models were developed to calculate habitat availability for mule deer and other tree/shrub associated wildlife within the reservoir area: one for the summer/fall period and one for the winter period.

Existing wildlife and vegetation studies for the Oldman River Project provided the necessary information for the development of both models. For example, the type of plant cover, aspect and land form are consistently identified as important habitat variables influencing the distribution of mule deer in the Oldman River area (Allison and Russell 1986), particularly during the winter. In the two habitat models for mule deer (and other tree/shrub associated wildlife), these variables were used in various combinations as the primary factors that determine habitat quality. The plant communities described and mapped for the study area by Hardy Associates (1986), in turn, provided the logical land units for the calculation of habitat quality and quantity. In all, a total of 179 different land units were identified within the reservoir area.

Because winter habitat is more important to the survival of mule deer (and other tree/shrub associated wildlife) than summer habitat, winter values were rated more highly than were the summer values. Therefore, in calculating a year-round rating for mule deer (and other tree/shrub associated wildlife), winter values made up 65% of the year-round value, whereas summer values made up the remaining 35%. Using the summer and winter habitat models and these weighting values, Habitat Suitability Indices (HSIs) for land areas within the reservoir area ranged from 0.0 (no value) for active gravel pits to 0.74 (good to excellent habitat) for a lightly-grazed saskatoon - chokecherry community.

5.2 ESTIMATING HABITAT AVAILABILITY

In the Habitat Evaluation Procedures, habitat availability -- a combined measure of the quality and amount of habitat present in the reservoir area -- is measured in units called *Habitat Units* (HUs). HUs are calculated for any given land area, simply by multiplying the HSI value for that land by its area (in this study, we used hectares). For the Wildlife Habitat Mitigation Plan, estimates of the area of each vegetation community were calculated using a computer-assisted digitizer.

5.3 HABITAT LOSSES FROM FLOODING

Based on the number of habitat units that are presently available to mule deer (and other tree/shrub associated wildlife) within the reservoir area, an estimated **689 HUs** will be lost to flooding. In terms of the specific uses of these habitats by mule deer (and other tree/shrub associated wildlife):

- **38 HUs** provide mostly cover (for example, Douglas fir communities),
- **445 HUs** provide mostly food (communities such as grasslands, cultivated fields and low shrubland areas), and
- **206 HUs** provide both cover and food (communities such as aspen and cottonwood stands and tall shrubland areas).

Because of the importance of winter cover for mule deer and other tree/shrub associated wildlife, the principal focus of the Wildlife Habitat Mitigation Plan is to enhance or create cover and cover/food habitat for wildlife.

5.4 OTHER WILDLIFE HABITAT

For other less abundant wildlife species in the Oldman River area such as raptors, waterfowl and marmots, a modelling approach to estimating habitat losses was not possible nor warranted. As a result, opportunities for habitat creation and enhancement for these groups were investigated on the basis of individual site use by each species or group of interest.

For example, it is known that six active prairie falcon eyries, two marmot colonies and some marginal waterfowl habitat will be potentially affected by the dam. Modification of alternative cliff habitats above the fsl of the reservoir may be undertaken by Alberta Public Works, Supplies and Services to provide new nesting ledges and cavities for prairie falcons, Ferruginous hawks and Canada geese. New burrow sites and habitat may be located and/or enhanced for marmots, and existing marmot colonies within the reservoir may be moved to these sites. Several existing wetland basins may be enhanced and a number of new upland wetlands and riparian wetlands may be created to provide higher quality habitat for waterfowl production.

As mentioned earlier, specialized habitats for some wildlife species and groups may also be created by the flooding and operation of the reservoir. Flooding around several large outcroppings in the reservoir will create large islands that are likely to be suitable as nesting sites for Canada geese and other waterbirds. Flooding along the upper edge of the reservoir may also provide opportunities to develop shallow depressional sites as riparian wetlands for waterfowl and other wetland-associated wildlife (e.g., mink).

6.0 MITIGATION TECHNIQUES

Three groups of mitigation techniques will be used to compensate for losses of wildlife habitat that are incurred during the construction of the Oldman River dam and the flooding of the reservoir:

- habitat protection
- habitat enhancement, and
- creation of new habitat

Specific methods for protecting and enhancing existing habitat and creating new habitat for wildlife in the Oldman River area are described below.

6.1 HABITAT PROTECTION

Blocks of upland tree and shrub cover, particularly thick stands of Douglas fir, as well as bottomland and coulee habitats are critical overwintering sites for mule deer and other wildlife in the Oldman River region (Allison and Russell 1986). Because flooding will destroy large areas of tree and shrub cover within the reservoir, the remaining blocks of native tree and shrub cover in the immediate vicinity of the reservoir were identified as essential components of the land base for the Wildlife Habitat Mitigation Program.

These same habitats are commonly used as pasture areas for cattle, particularly for overwintering, as they offer protection from wind and a ready source of water. However, without careful management of cattle use, coulee, bottomland and upland habitats can become over-grazed and, in some cases, can rapidly deteriorate due to erosion and destruction of the native plant cover. More importantly from a wildlife perspective, excessive use by cattle can destroy established native tree and shrub cover, as well as seedlings, thereby preventing rejuvenation of these communities.

To conserve and protect bottomland, upland and coulee habitats for wildlife, three habitat protection measures are proposed:

- perimeter fencing of the land base for the Wildlife Habitat Mitigation Program,
- implementation of range management plans for integrated use of pasturelands by wildlife and cattle, and
- development of reservoir clearing guidelines to minimize losses of tree and shrub habitats that will not be substantially affected by the flooding of the reservoir.

Such measures will help maintain existing areas of tree and shrub cover, and will promote the re-establishment of native ground covers, expansion of native tree and shrub communities, and stabilization erosion-prone slopes.

6.1.1 Perimeter Fencing

Habitat protection will generally involve the construction of a three strand barbed wire fence around the boundary of the protected area (Plate 2a) to permit management of certain land uses (e.g., cattle grazing, motorized recreational use). Reseeding of grasses and forbs, and planting of trees will also be necessary within some protected areas. In some cases, cattle will be excluded from the protected area until the native plant cover has regenerated. Controlled grazing may then be permitted on a rest-rotational basis. In some exceptional cases, cattle will be permanently excluded to protect fragile slopes, stream banks or critical bottomland shrub communities. Where cattle access to dugouts and other water sources is important, a fenced and gravelled access to water will be provided (Plate 2b). Because much of the Oldman River area is important for cattle range, permanent habitat protection will be used discriminately.

Perimeter fencing of the reservoir takeline will provide adequate protection for many of the proposed wildlife projects. However, some additional fencing will be required to protect wildlife areas outside of the reservoir takeline. To provide a low maintenance fence which is suitable for wildlife, a 3-strand barbed wire fence with posts at 5 m spacings is recommended with slight modifications to wire spacings and heights to permit easier movement of deer (Plate 3a).

6.1.2 Range Management

Although most ranchers in the vicinity of the reservoir have managed their range well, overgrazing in some areas has resulted in poor quality pasture for both cattle and wildlife. Good management of native and seeded range must involve :

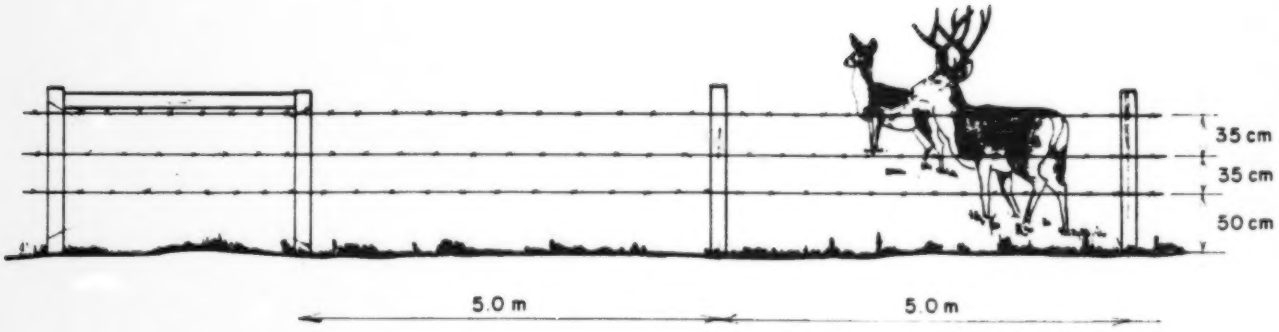
- use within the carrying capacity of the range,
- good distribution of cattle within the pasture, and
- careful timing of use

Maintenance of 45% residual cover or carry over on native rangeland and 25% carry over on seeded rangeland ensures that adequate root stocks have developed prior to the winter dormancy period. Soil moisture is also conserved by improving the catchment of snow. This, in turn, can result in better quality forage for cattle and increased grazing capacity. Good range management also provides food and/or cover for mule deer, small mammals, upland gamebirds and some songbirds. The timing of grazing also affects the carrying capacity as the growth of most grasses and forbs is severely reduced by early and repeated livestock use.

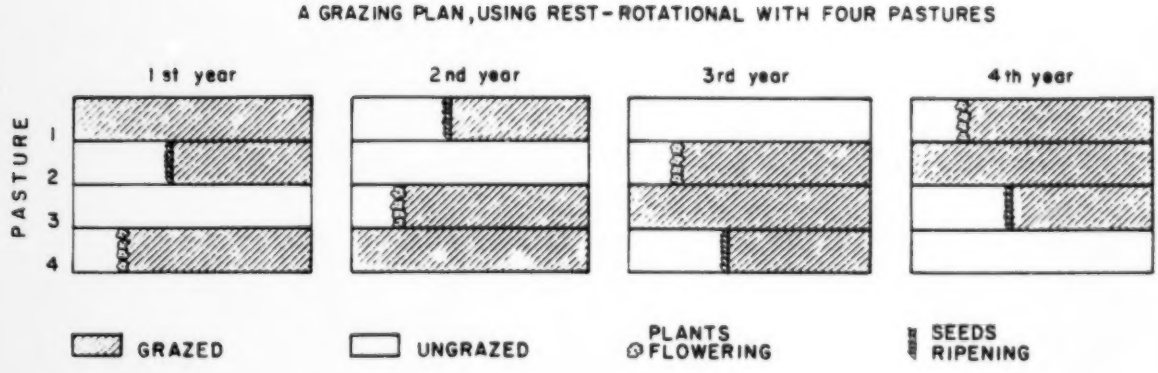
Range management has been suggested for several areas of native and seeded grasslands. It involves the use of a pasture rest-rotation system

a. Habitat Protection for Wildlife

b. Gravelled Water Access for Cattle



a. A Preferred Fence Design for Habitat Protection Projects



b. A 4-year Rest-rotational Grazing Scheme for Pastures (from Poston and Schmidt 1981)

(Plate 3b) to maintain and possibly improve cattle carrying capacity while also improving range quality for mule deer and other prairie wildlife. Range management plans will be developed to address the specific site conditions for each of the suitable grazing areas within the land base for the Wildlife Habitat Mitigation Program. Range management will generally require the construction and maintenance of a perimeter barbed wire fence around the designated pasture areas, and the excavation of dugouts and placement of salt licks to encourage good distribution of cattle throughout the pasture. Fenced and gravelled water access to wetlands and check dams will also be provided where appropriate.

6.1.3 Vegetation Clearing Guidelines

In conjunction with the clearing of the reservoir in 1989 and 1990, vegetation clearing guidelines will be established to retain those areas of tree and shrub cover that will not be substantially affected by the flooding of the reservoir. Proposed guidelines include:

- leaving shrubs of less than 3 meters in height within the flood zone of the reservoir,
- staging the clearing of the reservoir over 1989 and 1990 to delay disturbance of trees and shrubs as long as possible,
- minimizing the clearing of Douglas fir and trembling aspen communities in the area between the full supply level and the reservoir takeline (particularly where soil erosion will not threaten the moderate to long-term [> 25 years] survival of trees and shrubs),
- preserving stands of flood tolerant trees and shrubs in those areas of the reservoir where only shallow flooding (i.e., < 2 m) of short duration (e.g., < 5 weeks) is expected to occur during the normal operation of the reservoir, and
- maintenance of selected stands of vegetation within the borrow areas downstream of the dam.

6.2 HABITAT ENHANCEMENT

Habitat enhancement projects involve the improvement and/or expansion of existing sites and habitats to provide more suitable and/or larger areas of habitat for terrestrial and wetland wildlife than which presently exists. Four types of habitat enhancement measures will be incorporated into the Wildlife Habitat Mitigation Plan: enhancement of existing tree and shrub communities, wetland enhancement, modification of nesting cliffs, and improvement of native and seeded range.

6.2.1 Enhancement of Existing Tree and Shrub Communities

In a number of areas within the proposed land base for wildlife habitat mitigation, cultivation, heavy grazing, and/or the recent extended drought conditions have resulted in the loss of native tree and shrub cover or reductions in the area and vigour of native tree and shrub cover. Although habitat protection measures, as described in Section 6.1, will promote the re-establishment of cover, several measures are proposed to speed the recovery of native tree and shrub communities within the wildlife mitigation land base:

- placement of snowfencing in strategic sites to improve soil moisture, and
- planting of tree and shrub seedlings and cuttings.

6.2.1.1 Snowfencing. Snowfencing will be erected in a number of areas around the reservoir to increase snow catchment and, in turn, improve soil moisture conditions following snowmelt. Snowfencing will also protect existing vegetation and newly-planted seedlings from wind abrasion. Short sections (i.e., 50 m) of snowfencing will also be used to promote snow catchment for newly-constructed and existing check dams within the wildlife mitigation landbase (see Section 6.3).

In general, 1.2 m (4.0 ft) high wooden-slat snowfencing will be attached directly to the inside edge of the existing barbed-wire perimeter fence of appropriate wildlife mitigation projects. As the prevailing winter winds are from the southwest, preferred locations for snowfencing will be along the north-south or northwest - southeast (if present) axes of a fenceline. Thirty (30) meter lengths of snowfencing will be installed at approximately 50 m intervals along the fenceline to provide regular breaks in the snowfencing. Such breaks minimize potential barrier effects to mule deer and other wildlife, as well as reducing installation costs.

6.2.1.2 Tree and Shrub Plantings. In general, tree and shrub seedlings and cuttings will be planted in the areas directly downwind of the snowfencing. Such plantings will assist in the rapid re-establishment of tree and shrub cover in these sites. Encroachment or expansion of native trees, shrubs and ground cover along the lee side of the snowfences will also increase the amount of plant cover. In addition, as the tree and shrub seedlings and native species mature, they will increase the screening effect of the snowfence, thereby improving snow catchment and protection from the prevailing winds. Resulting increases in the availability and diversity of tree and shrub cover will not only increase the amount of food and cover for mule deer, but will also benefit small mammals such as jack rabbits, cottontail rabbits, coyotes, red fox, upland gamebirds, songbirds and some hawks.

The selection of tree and shrub species, numbers of seedlings, and the arrangement and location of seedlings will be specific to each mitigation project. Clumped and irregular shaped plantings will be used in preference to row plantings.

Plantings of trees and shrubs will primarily utilize native species from the Oldman River region. Native stock is preferred as it is self-reproducing, blends well with existing landscapes, and wildlife are accustomed to these species. To provide stock that is already conditioned to the biophysical conditions in the Oldman River area, cuttings and seeds of trees and shrubs were collected in the vicinity of the Oldman River reservoir during the spring and summer 1988 for propagation of containerized seedlings, bare root seedlings and cuttings. Species being grown include Douglas fir, limber pine, trembling aspen, black cottonwood, narrow leaf cottonwood, chokecherry, sandbar willow, saskatoon, hawthorn, red osier dogwood, buckbrush, snowberry, and potentilla. Most of these species will be available for planting in 1990 and 1991.

Tree and shrub plantings are only suggested in areas where landform and soils are suitable for the establishment of trees and shrubs. For example, tree and shrub plantings have been proposed on some north and northeast-facing slopes, and along stream banks, bottomlands, and the shorelines of most check dams and wetlands.

6.2.2 Grass Reseeding

In several areas where the present grass and forb cover has been severely overgrazed or damaged by erosion, reseeding and fertilizing of ground covers will be recommended. Improved range conditions will provide food and cover for small mammals and some songbirds, as well as forage for deer and upland gamebirds. Where cattle grazing is combined with wildlife use, reseeding will also benefit cattle through improved range conditions.

The selection of species, application rates and timing, and location of reseeding will be specific to each site. Reseeding will generally involve the use of dryland grass species, and legumes for soil conditioning.

6.2.3 Enhancement of Wetlands

There are a small number of natural wetlands in the immediate vicinity of Oldman River reservoir but, due to the present drought conditions in the area, most are completely or nearly dry. As wetland areas provide a diversity of habitats for waterfowl, as well as amphibians, reptiles, small mammals, upland gamebirds, some songbirds, raptors, and deer, improvement of water supplies to these wetlands and expansion of these wetlands can be a valuable tool in habitat improvements for wildlife.

Water supplies for these wetlands will be improved through the establishment of shelterbelts and snowfences around the wetlands, the planting and maintenance of dense grass and legume ground covers around the wetland edge, and transplants of emergent aquatic vegetation in the shallow (littoral) zones of the wetlands. As discussed above snowfencing and shelterbelts will be used to improve snow catchment and snowmelt for each wetland. Maintenance of dense grass and legume ground covers and emergent aquatic vegetation will also improve snow catchment. All of these

measures will also help reduce evaporative water losses during the open water period.

In most of these wetlands, supplemental water supplies will be provided to stabilize and maintain water levels, particularly until tree and shrub cover and ground vegetation is well established in and around the wetlands. Supplemental water supplies will also be employed during periods of poor water availability. Potential sources of water for existing wetlands include siphoning of water from the Oldman River reservoir, or pumping and gravity feed of water from the reservoir or large check dams.

Several of these wetlands will be expanded by shallow excavations in the vicinity of the wetlands. Topsoil will be stockpiled immediately prior to excavation, and respread over the new basin immediately after construction. As a result, natural wetland seed sources and root stock will be preserved and little replanting will be necessary. Wetland vegetation such as cattails and bulrushes may be transplanted into some of these basins.

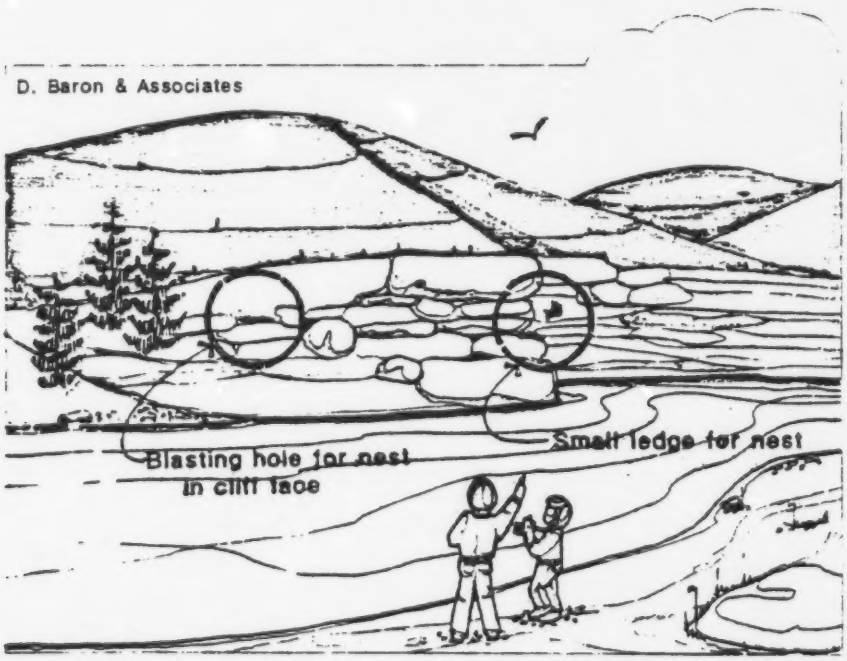
In several of the existing wetlands, earthen islands will be constructed to provide protected nesting sites for waterfowl (Plate 4a). Excess material from excavations will be used to construct islands or to increase the existing elevation of higher areas within the wetland basin. Coarse gravel or rip-rap may be installed around the island to reduce wave erosion. All islands will be capped with topsoil to promote establishment of ground cover on the island.

6.2.4 Enhancement of Cliff Nesting Sites

Based on surveys of nesting raptors in the vicinity of the Oldman reservoir, 6 prairie falcon eyries and 2 Ferruginous hawk nests will be affected by the construction of the dam and/or flooding of the Oldman reservoir (Young 1988a). During 1987, an inventory of alternative cliff sites for construction or modification of new nesting cavities and ledges was conducted in the Oldman River area by Environmental Management Associates Ltd (Young 1988b). The inventory identified eight different cliff areas along the Oldman and Castle rivers where falcon nests could be relocated. An additional survey of cliff habitats in summer 1988, suggests that the number of potentially-modifiable sites is greater than this number (R. Fyfe, pers. comm.). It also appears that there is substantial opportunity to develop nesting ledges for Canada geese, as well as nesting cavities and ledges for prairie falcons and Ferruginous hawks.

In most of the potential sites, ledges or nesting cavities will have to be created on the cliff face to provide suitable sites for nesting and roosting (Plate 4b). Based on experimental tests during the summer 1988, it appears that rough cavities are best created using sequential charges of explosives within specific rock strata. Sandblasting can then be used to finish the rough edges of the cavities. Ledges can be created using explosive blasting in specific rock strata and/or rock picks.

a. Enhancement of Wetlands for Wildlife



b. Enhancement of Cliffs for Falcons

6.3 CREATION OF NEW HABITAT

Six methods of creating new habitat for wildlife will be considered for the Wildlife Habitat Mitigation Plan: establishment of new upland tree and shrub communities (including the construction of check dams and irrigation systems), development of new bottomland shrub and tree communities, development of new wetland basins, creation of several islands within the reservoir, construction of rockpiles for marmots, and reclamation of borrow areas.

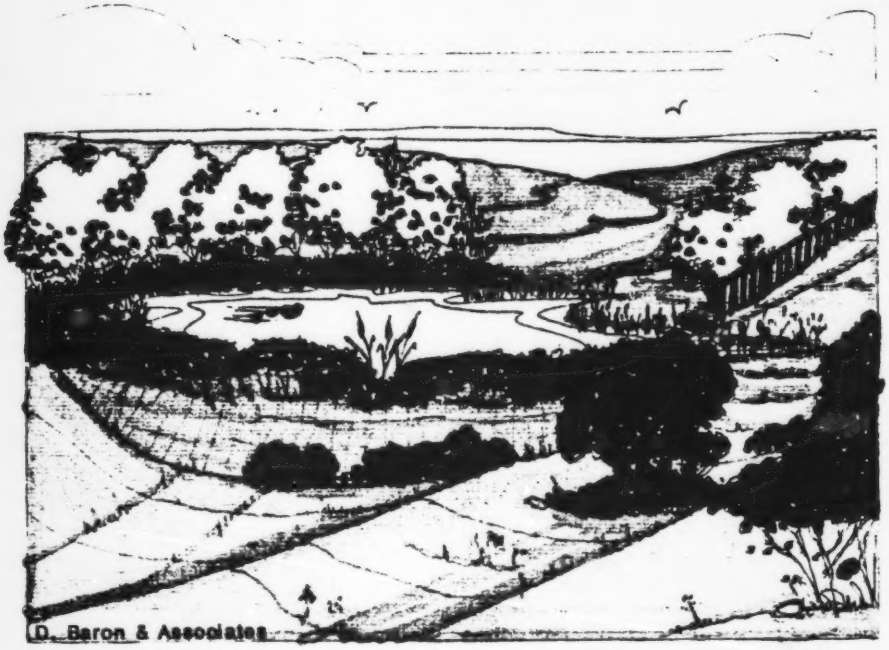
6.3.1 Development of New Upland Tree and Shrub Cover

In order to provide a good dispersion of tree and shrub cover around the reservoir for use by wildlife as core habitat areas and movement corridors, it will be necessary to establish new units of tree and shrub cover in exposed sites with moderate to poor soil moisture. To ensure the short and long-term survival of newly-planted trees and shrubs in these sites, it will be necessary to accumulate and store water in check dams, dugouts and wetlands, and to provide water to seedlings and cuttings on a frequent basis (particularly during the first five years after planting).

6.3.1.1 Check Dams. Lack of water during July to mid-September is one of the factors that limit the distribution of trees and shrubs in the Oldman River area. As evidenced by several existing dugouts in the vicinity of the reservoir, construction of inexpensive, low-profile earthen dams (Plate 5a) can create small wetland areas and excellent planting sites for shrubs and trees. Because check dams will provide small oases of tree, shrub and succulent ground covers, and readily accessible water, they will benefit a wide variety of wildlife. Waterfowl, shorebirds, and upland gamebirds may find them suitable for nesting. Deer and rabbits will likely use the tree and shrub fringe for winter browse and the shoreline grasses and sedges during early spring.

Based on local experience, it appears that check dams are best constructed in shallow saucer-shaped basins where spring snowmelt can provide water for the check dam (E. Schatz and E. Higgenbotham, pers. comm.). The shallow contours also provide a large growing area for wetland plants and water-tolerant shrubs such as willows, and permits the safe overflow of excess water during periods of high spring melt or rainfall. However, to ensure an adequate water supply throughout the summer period (when evaporative water losses are high), the central areas of most check dams will be a minimum of 3-4 m deep. Careful placement of shrub and tree corridors and/or snowfences will be used to improve snow catchment and increase the amount of water that is available for the check dam.

Check dams have been recommended as a means of providing water to newly-planted trees and shrubs in a large number of exposed areas around the reservoir. Recent trials on one wildlife project near the Oldman River dam have demonstrated the utility of subsurface irrigation tubing with slow release emitters in providing a regular water supply to seedlings throughout the June to September period. Use of gravity-feed subsurface irrigation tubing in



a. Checkdam Created

b. Tree and Shrub Planting for Wildlife

conjunction with check dams, dugouts and wetlands will be used to water tree and shrub seedlings in more exposed sites. Methods are currently being investigated to automate the operation of these irrigation systems. Such watering systems will be particularly important in helping to establish additional tree and shrub cover along the north shore of the Oldman mainstem area of the reservoir. Based on the experience of local landowners in establishing shelterbelts in exposed sites, a minimum of 3-5 years of watering is recommended.

6.3.1.2 Upland Trees and Shrubs. As discussed above, clump plantings and shelterbelts of native trees and shrubs will be planted in the vicinity of all check dams and dugouts. Snowfencing will also be utilized to promote snow catchment and reduce wind exposure for the new seedlings.

There are also several opportunities for development of upland tree and shrub habitat on small isolated areas of pasture or cultivated land adjacent to the reservoir edge. In all cases, these sites are located on small benchland areas within the three upper valley reaches of the reservoir. The protected locations of these sites and improved soil moisture (following flooding) will provide suitable areas for planting of upland trees and shrubs.

Native seedlings raised from local trembling aspen, chokecherry, saskatoon and hawthorn will be the primary plantings in the upland habitat areas. As discussed above (Section 6.2.1.2), native stock is preferred as it is self-reproducing and pre-adapted to the biophysical conditions in the Oldman River region. Wildlife are also accustomed to native species. Although ground covers in most sites will be allowed to establish through invasion of native species, some reseeding of grasses and forbs may be necessary in areas where soil erosion is or may become a problem (Section 6.2.2).

6.3.1.3 Shrub and Tree Corridors. Shrub and tree corridors will only be developed where protective cover is required to promote movements of mule deer and other wildlife along the reservoir edge.

Where possible, shrub and tree corridors will be located in bowl-shaped depressions, or on north-facing hillsides where accumulation of water and snow are more likely to ensure the survival of trees and shrubs. Snow fences will be used in most projects to improve the build-up of drifting snow which, in turn, increases soil moisture levels in spring and early summer. Snow fences will also reduce wind desiccation of newly-planted seedlings and cuttings.

In most locations, several irregularly-shaped rows of low to medium height shrubs will surround elongated clumps of aspen, poplars and/or spruce (Plate 5b). All seedlings will be watered regularly during the summer to early fall period for at least 3-5 years to improve survival of the seedlings.

6.3.2 Development of New Bottomland Habitat

In several locations near the upstream limits of the reservoir along the Oldman, Castle and Crowsnest rivers, existing pasture areas and riparian tree

and shrub communities along the valley floor will be flooded with 0.5 - 1.5 m of water for a 2-3 week period each spring. Because this is similar to flooding during the spring freshet, it may be possible to establish and maintain riparian shrub and tree communities and sedge meadows in these sites.

Because the sites for bottomland habitat development are physically well protected from the prevailing winter winds, and will provide good soil moisture conditions for tree and shrub plantings, riparian habitat development offers an extremely valuable and effective means of replacing some of the bottomland habitats lost to flooding. These habitat areas will provide good winter and summer habitat for deer, as well as year-round habitat for a number of small mammals and upland gamebirds. During the spring flood, deer may also use the higher areas within these developments for birth of fawns. New bottomland habitats will also likely be used during the spring to fall period by some songbirds and, perhaps, nesting Ferruginous hawks.

Development of riparian habitat will require selection of areas within each site based on the projected depth and duration of flooding for planting of trees such as narrow leaf and black cottonwoods, shrubs such as willows, red-osier dogwood and wolf willow, and flood tolerant grasses and sedges (Plate 6a). For example, black cottonwoods can be planted in areas where flooding will be shallow and brief. In contrast, narrow leaf cottonwoods and sandbar willow can be planted in areas where deeper and longer flooding is anticipated. Sedges and flood-tolerant grasses can be planted to stabilize the soil. Several of the riparian habitat development sites will also provide opportunities for wetland development (see below). In one instance, a short dike with a water control structure may be necessary to limit the duration of flooding within the proposed project area.

6.3.3 Wetlands

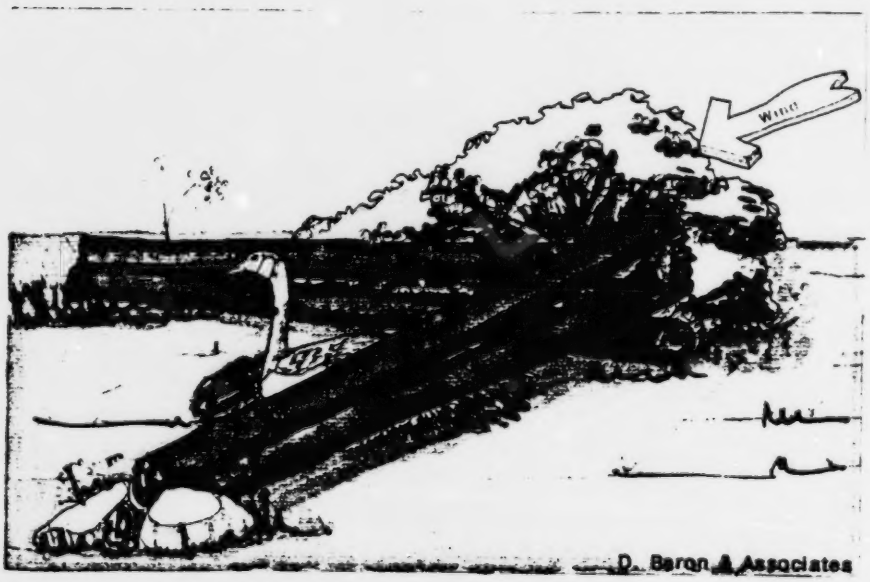
The creation of new wetland habitat in the vicinity of the Oldman River reservoir will involve two different techniques:

- the construction of new wetland basins in upland sites, and
- the construction of depressional areas or use of existing depressions along the upper flood zone of the reservoir.

As discussed earlier for wetland enhancement (Section 6.2.2), wetlands provide a diversity of habitats for waterfowl, as well as amphibians, reptiles, small mammals, upland gamebirds, some songbirds, raptors, and deer.

6.3.3.1 Construction of New Wetland Basins. Several proposed wildlife habitat mitigation projects may include the development of new wetlands through the construction or enlargement of depressional sites within the project area. In all cases, new wetlands will only be constructed where water can be provided from existing sources (e.g. other wetlands) or new water sources (e.g., check dams, pumping or gravity flow from other water storage areas). Nesting islands will be

a. Riparian Planting for Wildlife



b. Log Nest Crib for Canada Geese

constructed during the excavation of all new wetlands to provide secure nesting and loafing sites for waterfowl.

All of the proposed sites for new wetlands are currently pasture or cultivated land, and some measures will be necessary to establish wetland vegetation. Soil fertilization and/or innoculation may be necessary to promote establishment of a natural detrital chain. Transplants of reeds, bulrushes and sedges from existing local wetlands and planting of willow seedlings will likely be necessary to establish aquatic vegetation and a riparian shrub fringe. Snowfencing and establishment of shelterbelts will be used to improve snow catchment and provide a greater volume of runoff for the wetland.

6.3.3.2 Construction of Riparian Wetlands. New riparian wetlands may be provided through the construction of terraces and/or dikes within the upper flood zone of the reservoir (i.e., up to 3 m below the full supply level). All of the proposed sites will backflood when the reservoir is brought to full supply level, and hold water 0.6 m below full supply level when the reservoir is lowered. Where appropriate, nesting islands for waterfowl and Canada geese will be constructed in these wetlands. Narrow leaf cottonwoods, sandbar willow, sedges and aquatic plants will be planted in the area immediately at and below full supply level. Black cottonwoods, sandbar willow, red osier dogwood, and white spruce will be planted in the areas immediately above full supply level. The proposed riparian wetland projects will provide bottomland tree and shrub habitats for wildlife, as well as additional wetland habitat around the reservoir, edge.

6.3.4 New Island Habitats

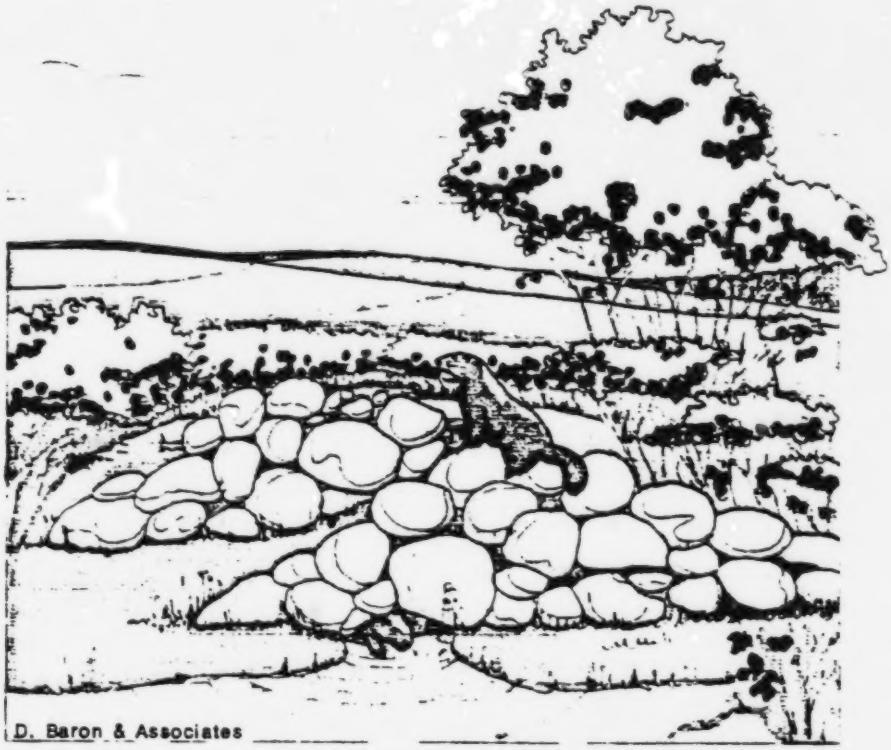
Flooding around several elevated outcrops along the Castle and Oldman rivers may create suitable nesting islands for Canada geese. Two of these islands may also provide suitable fawning habitat for mule deer.

Few modifications will be necessary to create nesting sites for Canada geese. V-shaped log cribs can be constructed at several locations on each island to provide sheltered nesting sites for geese (Plate 6b). Reseeding of the lower areas of the islands near the floodline may be necessary to stabilize soils eroded by wave action. All existing tree and shrub cover at these sites will be maintained.

6.3.5 Rockpiles

Two yellow-bellied marmots colonies will be flooded by the Oldman reservoir. On the basis of landform and vegetation communities, two potential sites for transfer of these colonies have been suggested.

One site contains a rock outcrop that can provide a suitable burrow area for the marmots. At the other site, however, a burrow site will have to be provided through the construction of a rockpile (Plate 7a). The rockpile should be a minimum of 2 m wide, 3 m long and 1.5 m high and be constructed primarily of large boulders (e.g., average diameter > 0.5 m). Local mudstones and sandstones are suitable for use. The rockpile should be located within 5 m



a. Rockpiles for Marmot Relocations

b. Reclamation of Gravel Pits for Wildlife

of the existing chokecherry and saskatoon shrub cover to provide a source of food. Several artificial burrows may be created at each site using a gas-powered post auger (20 cm auger bit) to promote immediate acceptance of the site by marmots.

6.3.6 Reclamation of Borrow Areas

During the construction of the Oldman River dam, several large borrow areas will be developed in areas above the full supply level of the reservoir or downstream from the dam site. Most of these sites will be reclaimed as wildlife habitat.

Borrow pits that are to be developed as upland wildlife habitat will be contoured during the final extraction of gravel to provide a knob and kettle landform with an irregular pit edge (Plate 7b). This method has been used in several borrow pits in Alberta to successfully create habitat for elk and deer (Green and Salter 1986). The knob and kettle landform will provide numerous depressions where water can collect, thereby creating many sites highly suited for planting of trees and shrubs. The rough landscape also provides physical and visual protection for wildlife.

7.0 A CONCEPTUAL PLAN FOR WILDLIFE HABITAT MITIGATION

The Oldman, Castle and Crowsnest River valleys provide a complex of wildlife habitats that are important to the survival of deer, a number of small mammals, upland gamebirds, songbirds, raptors and some waterfowl. The incised portions of the river valleys are largely uncultivated, and provide mule deer and other wildlife with physical protection from the prevailing winter winds, as well as accessible sources of winter browse and food. Canada geese and prairie falcons use some of the cliff areas along these three valleys for nesting and rearing of young. Marmots, coyotes and red foxes are also known to den within the reservoir area.

The valleys of the three rivers also serve as local movement corridors for mule deer and white-tailed deer. Data from several wildlife studies conducted by Alberta Environment and the Alberta Fish and Wildlife Division, as well as from local information sources, suggest that the valleys provide routes from downstream bottomland habitats to winter and summer habitat in the Lundbreck Hills and Porcupine Hills. Flooding of the reservoir area will thus destroy food and cover for a number of wildlife species, as well as movement corridors for deer.

The remaining coulees and treed areas above the floodline will provide some cover and food for wildlife. However, because cultivated and pasture land surrounds most of the reservoir, there will not be enough alternate habitat for wildlife in the immediate reservoir area following flooding. In particular, mule and white-tailed deer traveling around the reservoir may be forced to travel long distances away from cover, unless some mitigative measures for wildlife are provided.

7.1 THE CONCEPT

The primary objectives of the Wildlife Mitigation Plan are to:

1. To minimize the potential negative impacts of the Oldman River dam project on wildlife species, and

2. To take advantage of mitigation opportunities arising from the development of the dam and reservoir.

To achieve these objectives it will be necessary to provide core areas of cover and food for mule deer and other shrub and tree-associated wildlife, as well as movement corridors along the reservoir edge.

Core habitat areas are primarily comprised of moderate to high quality blocks of existing tree and shrub cover which will not be lost to flooding. The majority of these projects will involve habitat protection in conjunction with additional plantings of trees and shrubs, but several core habitat projects will be

created through development of new bottomland and upland habitat, check dams, or shelterbelts. Several of the core habitat areas will include wetland enhancement or creation as an integral component of the proposed project.

Movement corridors should be designed primarily to assist local and long distance movements of mule deer, and to a lesser degree, white-tailed deer, around the reservoir edge. Because mule deer do not normally like to be more than 0.8 km (1/2 mile) from some form of cover, groups of trees and shrubs or physical cover should be provided at one mile intervals (or less) between the core habitat areas. Movement corridors should also be designed to link with known movements routes along the Oldman River and from the Porcupine and Lundbreck Hills. Many of the movement corridor projects may involve construction of check dams with associated tree and shrub plantings, establishment of shelterbelts, or protection of the tree and shrub fringe on the reservoir edge.

To benefit other wildlife groups, the plan also includes the enhancement and creation of wetlands and check dams to benefit water-associated wildlife, and to provide better growing conditions for transplanted trees and shrubs. Special structures such as rockpiles for marmot burrows, modifications of cliff habitats for relocation of prairie falcon nests, and creation of nesting sites for Canada geese on the reservoir islands have also been incorporated in the plan.

7.2 DEVELOPMENT OF AN ACTION PLAN FOR WILDLIFE HABITAT MITIGATION

During the initial planning phase of the wildlife habitat mitigation program, a large number (approximately 145) of opportunities for protection and enhancement of existing habitat and creation of new habitat were inventoried in the vicinity of the Oldman reservoir. Opportunities were identified only on the basis of existing biophysical site conditions, and the potential to improve existing habitat conditions or create new habitat using proven mitigation methodologies or new technological advances in wildlife habitat mitigation. The inventory of mitigation opportunities provided a broad range of potential projects that could be selected for inclusion in the action plan for wildlife habitat mitigation.

However, the selection and priorization of mitigation projects for inclusion in the action plan, must take into account factors associated with the biological requirements of wildlife, compatibility with adjacent land use, land ownership, project cost, and project effectiveness. To meet the assumptions discussed earlier in this report (Section 3.0), the following criteria were used to select projects for inclusion in the action plan for wildlife habitat mitigation:

- *Land Ownership*: Wherever possible, wildlife projects will be located on Crown land with low agricultural capability.

- *Distribution of Projects*: To ensure a good distribution of potential mitigation projects throughout the Oldman, Crowsnest and Castle river areas, small and large scale habitat projects will be identified in the upstream and downstream areas from the reservoir, as well as in most areas around the reservoir.

- *Compatibility with Existing Habitat*: Habitat enhancement and creation projects will be designed to complement existing blocks of important food and cover for wildlife. Development of habitat blocks or movement corridors was also avoided in the vicinity of grain or forage crops.

- *Diversity of Wildlife Needs*: In order to benefit as wide a range of wildlife as possible, while still providing alternate habitat for mule deer, mitigation projects for land-associated and water-associated wildlife will be considered.

- *Distance to Other Habitat Areas*: Because mule deer are reluctant to travel long distances away from plant cover or physical cover such as bluffs, we attempted to create blocks of habitat no more than 1.6 km (1.0 mile) from the next nearest habitat area.

- *Suitability for Tree and Shrub Plantings*: Sites suitable for planting of trees and shrubs (for example, moist northern slopes and bottomlands) will be preferred over areas where planting success would be questionable.

- *Suitability for Construction of Check Dams*: Good soil moisture is essential to the survival of trees and shrubs in exposed locations in the Oldman region. In exposed areas where tree and shrub cover is required, shallow basin areas that are suitable for construction of check dams will be preferred project sites.

Using these criteria and ongoing input from the Local Fish and Wildlife Sub-committee, an Action Plan for Wildlife Habitat Mitigation will be prepared as a companion report to this mitigation strategy. The Action plan will describe actual projects which will be implemented to provide suitable replacement habitat for wildlife, the implementation schedule for the Wildlife Habitat Mitigation Plan, and an evaluation and maintenance program for the habitat projects.

7.3 INTEGRATION WITH OTHER COMPONENTS OF THE OLDMAN RIVER DAM PROJECT

The construction and operation of the Oldman River dam and the implementation of environmental mitigation programs for fisheries, recreation, vegetation, historical resources, agriculture and transportation will afford a broad range of opportunities for interaction and integration with the Wildlife

Habitat Mitigation Program. Where possible, all such opportunities will be pursued in order to maximize benefits to the Alberta public.

7.3.1 Integration with Dam Construction and Reservoir Operation

During the construction of the Oldman River Dam, a variety of opportunities are expected to arise for the enhancement or creation of wildlife habitat in conjunction with the design and implementation of specific engineering tasks. Potential opportunities include:

- use of excess fill to create wind berms, dikes and riparian benches,
- modification of excavated pits for creation of waterbodies,
- provision of boulders and gravel for rip-rap on nesting islands, check dams and cattle water access points, and construction of burrow sites for marmots,
- stripping of topsoil from construction sites and the reservoir for use in habitat projects, and
- salvage of logs and other materials during clearing of the reservoir

Although an operations plan has not yet been finalized for the Oldman River reservoir, it is also anticipated that opportunities for development and maintenance of riparian wetlands and riparian trees and shrubs will become available.

7.3.2 Integration with the Fisheries Habitat Mitigation

The fisheries plan has primarily focused on creation of new spawning and rearing habitat upstream and downstream from the Oldman reservoir. As a result, there is only a small spatial overlap between the fisheries and the wildlife mitigation plans. However, a number of the proposed projects for fisheries habitat, particularly the restoration of riparian tree and shrub cover, will benefit some wildlife (e.g., ungulates).

Conversely, fish may directly or indirectly benefit from some of the proposed wildlife habitat protection projects involving the conservation of tree and shrub cover and the seasonal or permanent exclusion of cattle along parts of the reservoir edge, stream banks, and in coulee bottoms. Improved tree and shrub cover in some areas may provide protected and shaded areas for fish. Stabilization of stream banks by trees, shrubs and ground cover and exclusion of cattle will improve water quality for fish by reducing silt loads in the water.

7.3.3 Integration with Recreation

The recreation plan currently focuses on the development of recreational facilities in three areas around the reservoir: the Damsite area (immediately downstream of the dam), the Interpretive Centre (near the main dam), and the Islandview site (just east of the confluence of the Oldman and

Crowsnest rivers), as well as the construction of fisheries acccess points at several sites around the reservoir edge.

Although some recreation developments will remove small areas of tree and shrub cover for wildlife, there are also opportunities to include some protection measures and habitat development for wildlife. In the proposed Damsite development, corridors of cottonwood and shrub cover will be maintained along the river and valley edge. These corridors will provide some food and cover for wildlife, which will likely be most intensively used by wildlife in the winter period when few recreational users will be present. The rows of cottonwoods and shrubs will also provide year-round movement corridors for wildlife. At the Islandview site, extensive plantings of native deciduous trees, shrubs and evergreens are proposed to protect and improve the landscape at a day-use area and boat launch. These same plantings will provide winter food and cover for wildlife, as well as movement corridors. It also appears that the construction of a wetland area for wildlife on the Islandview site, as suggested in the Wildlife Mitigation Plan, is complementary to the proposed recreational development.

In order to minimize human disturbance of critical wildlife habitat around to the reservoir, fisheries access points were generally located only in areas of moderate to low quality habitat where human activities could be effectively controlled.

7.3.4 Integration with Vegetation

The frequency and timing of spring flooding and changes to summer flows are being analysed to assess downstream effects, including downstream vegetation impacts. Preliminary analyses indicate that the Oldman River Dam Project will not significantly affect floods of the magnitude that will promote cottonwood seedling establishment, and will actually improve summer flow conditions (Alberta Environment 1988b).

As downstream riparian communities provide important seasonal or year-round habitat for a variety of terrestrial and semi-aquatic wildlife, any benefits to riparian tree and shrub communities will directly benefit wildlife.

7.3.5 Integration with Historical Resources

Numerous archaeological and historical sites exist around the Oldman reservoir. To avoid disturbance or destruction of important sites during the construction of physical structures for wildlife habitat projects, all of the land base for the wildlife habitat mitigation program will be screened by Alberta Culture, prior to the initiation of detailed planning and implementation.

7.3.6 Integration with Agriculture

As discussed earlier in this report, the final selection of wildlife habitat projects will take into account the potential for land use conflicts between agricultural activities and wildlife. Wherever possible, wildlife projects will be preferentially located on nonarable lands within the existing Crown-owned landbase that are adjacent to native and cultivated pasture, rather than cereal

crops. Cattle grazing will be incorporated into the long-term management plans for some land units within the wildlife habitat land base through the implementation of range management plans, reseeding and fertilization of some range areas, and provision of a gravelled water access in some wetlands and check dams.

7.3.7 Integration with Transportation

Development of an alternate highway corridor along the north side of the reservoir and the construction of bridge crossings on the Oldman northstem and Crowsnest rivers may provide opportunities for enhancement or creation of wildlife habitat. Potential opportunities include:

- use of excess fill to create wind berms, dikes and riparian benches,
- use of the road fills and elevated culverts to create small water reservoir, and
- salvage of topsoil from construction sites for use in habitat projects.

Opportunities may also arise to reduce road kills of deer and other wildlife by (1) modifying the frequency of road crossings by wildlife in problem sites through the use of drift fences or page-wire fencing, and (2) providing ramps under bridges.

8.0 LITERATURE CITED

Alberta Environment. 1988a. Oldman River Dam. Wildlife. Oldman River Dam Project Office, Alberta Environment, Edmonton. 6 pp.

Alberta Environment. 1988b. Oldman River Dam. Vegetation. Oldman River Dam Project Office, Alberta Environment, Edmonton. 6 pp.

Allison, L.M. and H.J. Russell. 1985. Late winter distribution of cervids in the vicinity of the proposed Oldman River reservoir 1985. Prepared by Salix Enterprises Ltd. for Alberta Environment, Planning Division, Edmonton. 63 pp.

Allison, L.M. and H.J. Russell. 1986. Winter studies of cervids in the valleys of the Oldman River and its tributaries 1985-86. Prepared by Salix Enterprises Ltd. for Alberta Environment, Planning Division, Edmonton. 53 pp.

Eccles, T.R., R. Dams, H.R. Hamilton, P. McCart, E.J. McCullough and R.E. Salter. 1986a. Overview environmental assessment of four potential reservoir developments on Willow Creek, Alberta. Prepared by LGL Ltd. for Alberta Environment, Planning Division, Edmonton. 338 pp. + map pocket.

Eccles, T.R., J.E. Green, C. Thompson and G.F. Searing. 1986b. Slave River Hydro Project mammal studies, Volume 1. Final Report. Prepared by LGL Ltd. for the Slave River Hydro Project Study Group, Edmonton. 368 pp. + map folio (Volume 2).

Green, J.E. and R.E. Salter. 1986. Phase III: An inventory of Alberta's drainage requirements. Wildlife component. Prepared by LGL Ltd. for the Interdepartmental Steering Committee on Drainage, Edmonton. 174 pp.

Green, J.E., R.E. Salter and C. Cooper. 1986. Habitat assessment models for wetland-associated wildlife in the agricultural areas of Alberta. Prepared by LGL Ltd. for the Inventory of Alberta's Drainage Requirements, Alberta Environment, Planning Division, Edmonton. 246 pp.

Hardy Associates (1978) Ltd. 1986. Vegetation inventory: Oldman River Dam. Prepared for Alberta Environment, Planning Division, Edmonton. 73 pp. + appendices and map pocket.

U.S.F.W.S. 1980. Habitat evaluation procedures (HEP) ESM 102. Prepared by Division of Ecological Services, U.S. Fish and Wildlife Service, Washington, D.C. n.p.

Westworth, D.A. and L.N. Brusnyk. 1984. Phase I overview for the Oldman River Dam environmental mitigation/opportunity plan. Prep. for Alberta Environment by D.A. Westworth and Associates Ltd. 64 pp.

Young, D.A., D.A. Weidl, L.M. Allison and H.J. Russell. 1986. Oldman River Dam wildlife investigations - spring and summer, 1985. Prepared by Environmental Management Associates and Salix Enterprises Ltd. for Alberta Environment, Planning Division. Edmonton, Alberta. 91 pp. + appendices.

Young, D.A. 1988a. A preliminary raptor mitigation program for the Oldman River Dam project. Prep. for The Delta Environmental Management Group Ltd. and Alberta Environment, Planning Division by Environmental Management Associates Ltd. 11 pp.

Young, D.A. 1988b. Prep. for The Delta Environmental Management Group Ltd. and Alberta Environment, Planning Division by Environmental Management Associates Ltd. 21 pp.